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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : A01K 1/12 // 1/00		A1	(11) International Publication Number: WO 00/01226
			(43) International Publication Date: 13 January 2000 (13.01.00)
(21) International Application Number: PCT/SE99/01188			(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
(22) International Filing Date: 30 June 1999 (30.06.99)			
(30) Priority Data: 9802356-7 1 July 1998 (01.07.98) SE			
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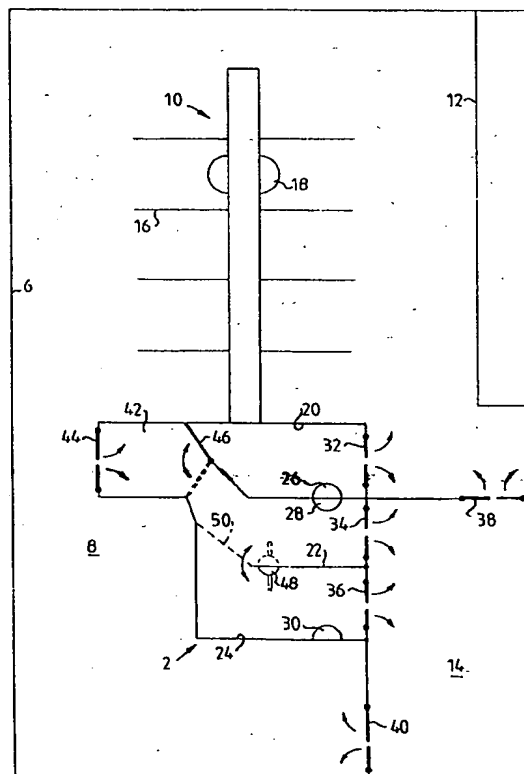
Published

With international search report.

(54) Title: SEPARATING SYSTEM

(57) Abstract

The present invention relates to an apparatus (2) for separating lactating animals such as cows. First (20), second (22) and third (24) animal stalls are arranged in a side by side configuration. Each stall is provided with a water supply means (26, 28, 30). A separation gate (46) associated with an identification means (44) is arranged to allow an animal not due for milking into said first (20) animal stall and an animal due for milking into said second (22) or third (24) animal stall.



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SEPARATING SYSTEM

TECHNICAL FIELD OF THE INVENTION

The present invention relates to an apparatus for separating animals, comprising at least a first and a second animal stall and a separation gate associated with means for identifying an animal individually.

10

BACKGROUND OF THE INVENTION

In automatic milking systems for lactating animals such as cows, advantageously the milker or milking robot can be made attractive to the animals by offering a fodder concentrate. However, sick animals and animals in heat might not be attracted by the concentrate. Thus they will not be milked and it will not be possible to separate sick animals as "alarm cows" automatically.

15

Water is essential for lactating animals like cows. They are attracted by water even when they are too sick to eat. If an animal is in such a bad shape that it is not even attracted by water any longer, the animal should be defined as "consumed" and sorted out.

20

One solution would be to offer water exclusively in or at the entrance to the automatic milker. Except for "consumed animals" this would make the automatic milking system attractive to all animals under all conditions. From women and breast feeding we know that giving milk creates thirst!

25

In previously known loose-housing systems water is made easily available by means of a sufficient number of troughs and/or bowls in the stall. Alfa Laval Agri has introduced "The CLARINATM" water programme, which offers different solutions for the loose-housing stall as well as the tied-up stall including the stainless steel valve trough, which provides easy access to large quantities of fresh water. Other examples of available solutions for a good water supply according to said programme are; the "Oasis waterer", which keeps the water cool and fresh in heat and maintains the temperature in cold conditions, the stainless steel "ColoradoTM" bowl and the "DaniaTM" bowl, which delivers at least twenty litres per minute, the all purpose "MasterTM" bowl and the robust "BasisTM" bowl specially suited for young cattle. As it is commonly known that lactating animals such as cows like to drink fresh water from a waterer with high volume and a large water surface, these water bowls and troughs have been designed to be hygienic, provide large drinking surfaces and high flow rates, all to accommodate the animals' natural way of drinking. The above mentioned drinking facilities can, except for lactating animals other than cattle, e.g. goats, sheep, horses, buffaloes and the like of course also be used for non-lactating animals.

However, even if the troughs and bowls are indeed easily available and arranged at a sufficient number in the stall and at locations with easy access, considerable difficulties will appear to measure the water consumption for each individual animal. Of course it is conceivable to arrange identification means at every bowl, but such an arrangement will be expensive and complicated to provide. It is also difficult to use such a watering arrangement to make the milker in automatic milking systems attractive to all animals including "alarm cows" under all conditions, with the purpose of making it possible to separate "alarm cows", even if they are too sick to eat.

DE-A1-37 02 465 shows a method and a means in a loose-housing system for automatic milking, feeding and watering of cows, which are carrying an identification

device. The milking schedule for each separate cow is programmed into a identification- and control unit, by means of which each cow is identified at an entrance to a separate milking stall. The cow will be let into the stall only if, according to her milking schedule, she is due for milking and a milking stall is free. Feeding- and watering stations are arranged at locations which are separated from the milking stalls. The identification- and control unit is associated to identification sensors, which can be located not only at the entrance to each milking stall, or at a central entrance to the milking stalls, but also at the feeding stations.

WO 96/05723 discloses a construction including an implement for milking animals such as cows, equipped with a milking robot. According to the description page 10, lines 10-21, fig. 1 and claims 31-35, a computer-controlled drinking bowl may be placed in or at a milking/feeding box 1, with the aid of which liquid, such as water and/or milk, can be supplied depending on the animal. Furthermore, the liquid and/or (concentrated) fodder can preferably be supplied during the anticipated milking period and/or pre-treatment period and/or after-treatment period. Thus it is possible to adapt the feeding and/or drinking period when it is found that the teat cups cannot be fitted on the teats of an animal in the anticipated period of time, or when the animal kicks off one or more teat cups and the milking cluster is to be connected again.

In 1995, Neville Prescott submitted a thesis to the University of Bristol, "Dairy Cow Behaviour and Automatic Milking", according to which "it has been suggested that locating the cow's only source of water in the AMS could be used to encourage attendance (Artmann 1992). While this will not work operationally, since attendance will vary with the environmental temperature, the cow's milk yield (hence her water requirements) and the water content of the forage, it will also force cows to attend to the system since they need to drink water. The effect of using water as the lure for

attracting cows to the AMS needs careful consideration before it is implemented in commercial systems, to ensure that it does not unduly stress the cows”.

5 The state of the art does not, however, deal with the problem of separating sick animals automatically from the herd.

SUMMARY OF THE INVENTION

10 An object of the invention is to solve the described problems with regard to previously known loose-housing systems or animals grazing in the fields, by providing an improved animal separating means.

15 The problems are solved by means of an apparatus as initially defined, characterized in that at least one of said first and second animal stalls is provided with a water supply means and in that said separation gate is arranged to allow at least a first category of animals into said first animal stall and at least a second category of animals into the other.

20 Alternatively the problems are solved by means of an apparatus as initially defined, characterized in that at least one water supply means is provided before said separation gate, which is arranged to allow at least a first category of animals into said first animal stall and at least a second category of animals into the other.

25 The problems are also solved by means of a corresponding method as initially defined comprising the following steps:

- providing at least a first and a second animal stall and a separation gate associated with means for identifying an animal individually;

characterized by providing at least one of said first and second animal stalls with a water supply means for separate watering of each animal;

- 5 - allowing at least a first category of animals to enter into said first animal stall and at least a second category of animals to enter into the other by means of said separation gate.

Alternatively a corresponding method as initially defined is characterized by providing at least one water supply means before said separation gate for separate watering of each animal;

- 10 - allowing at least a first category of animals to enter into said first animal stall and at least a second category of animals to enter into the other by means of said separation gate.

- 15 Advantageously said first animal stall exits into a first section for said first category of animals and said second animal stall exits into a second section for said second category of animals. Hereby is achieved that different categories of animals after being watered can be separated from each other and guided into different sections.

- 20 Preferably said first and second animal stalls are provided with at least one common automatic milking means, which is arranged for automatic milking of each animal individually. Hereby is achieved that each animal which is due for milking can be individually watered and milked and thereafter, depending on the milk quality be guided into one of the first and second sections.

- 25 Further it is advantageous that one of said first and second sections comprises feeding- and resting- sections with at least one feeding station and that the other one of said first and second sections comprises a separating section for separation of the first or second category of animals from the herd. Hereby is achieved that each animal, after being watered and milked, by its own choice can eat in the feeding section

and rest in the resting section. It is also achieved that a sick animal, which is observed during milking, can be separated into the separating section.

5 Preferably, the water supply means is arranged to supply drinking water and said identification means is arranged to allow an identified animal to enter into one of said second and third animal stalls being provided with automatic milking means only when it is reported as available and the animal in question is identified as ready for milking. On the other hand the first animal stall is also provided with a water supply means but no milking means. Alternatively, it is also achievable to arrange 10 the water supply means before the separating gate. Hereby is achieved that each animal is provided with its total need of drinking water, even when to sick to eat and independent of its milking status.

15 Further preferred embodiments and advantageous developments appear from the description, the dependent claims and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

20 The invention will be described in more detail below by means of examples of embodiments and with reference to the accompanying schematic drawings, in which;

Fig. 1 is a view of a first embodiment of an apparatus for separating animals according to the invention, in which each animal stall is provided with a water supply means, the animal stalls being located side by side and provided with a common 25 automatic milking means;

Fig. 2 shows a second embodiment of an apparatus similar to fig. 1, in which the water supply means is provided before the separating gate;

Fig. 3 is a view of an alternative arrangement of the embodiment in fig. 2, in which the second and third animal stalls are provided with a separate automatic milking means;

Fig. 4 shows an alternative arrangement of the embodiment in fig. 3, in which the second and third animal stalls are located in a tandem configuration;

Fig. 5 is a view of an alternative arrangement of the embodiment in fig. 4, in which the animal stalls are provided with a common automatic milking means.

The reference numerals are identical for corresponding parts in the different embodiments of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 is a schematic view of a first embodiment of an improved apparatus 2 for separating animals in a free walking system and especially for separating different categories of lactating animals. The apparatus may be located in an area 4, which on each side is surrounded by walls or fences 6. The area 4 may be arranged with a first section 8, having a resting area 10 and a conventional feeding passage 12, and a second section 14 for separation of a predetermined category of animals from the herd. Said resting area preferably being provided with conventional resting booths 16 and a couple of said resting booths being arranged with conventional concentrate supply means 18.

The separating apparatus 2 is associated with said first 8 and second 14 sections and in this embodiment comprised of at least a first 20, a second 22 and preferably also a third 24 animal stall, said stalls being arranged in a side by side configuration. Each stall is provided with a first 26, a second 28 and a third 30 water supply means and a first 32, a second 34 and a third 36 exit gate respectively. The first animal stall 20 exits by means of said first exit gate 32 into the first section 8, close to the rest-

ing booths 16 and the feeding passage 12. The second 22 and third 24 animal stalls exit into the separating section 14 by means of said second 34 and third 36 exit gates respectively. Said separating section in turn exits into the first section 8 by means of at least a feeding gate 38 and a resting gate 40.

Said animal stalls 20, 22, 24 are associated with a common entrance passage 42, which is provided with a combined entrance and identification gate 44 at its free end and a separation gate 46 at its animal stall side. The separation gate is arranged to be movable between two positions depending on the present animal status or category of animals. In a first position drawn with broken lines, an animal which is not due for milking is allowed to the water supply means 26 which is arranged in the first animal stall 20. In a second position drawn with continuous lines, an animal which is due for milking is allowed to one of the water supply means 28, 30 which are arranged in the second 22 and the third 24 animal stalls respectively.

Fig. 2 shows a second embodiment of an apparatus similar to fig. 1, in which the water supply means 26' is provided before the separating gate 46 and the water supply means 28; 30 are omitted. In this embodiment all categories of animals, e.g. independent of animal status, are watered by means of said water supply means 26' in the entrance passage 42 after being identified by said identification gate 44 and allowed into said passage. Said separating gate 46 is manoeuvred accordingly depending on the present animal status.

As appear from both fig. 1 and fig. 2, the second and third animal stalls may be provided with a common previously known automatic milking means 48, which is arranged to be pivotable between the second and third animal stalls. Hereby it is achievable to perform automatic milking of an animal in either of said second and third animal stalls 22, 24 and to allow another animal into the free animal stall to be milked as soon as the milking of said first animal is completed.

If desirable the third animal stall 24 may be omitted and the automatic milking means 48 be stationary arranged in the second animal stall 22. In this case the passage between said second 22 and third 24 animal stalls is closed by means of a gate or wall 50, which is drawn with a broken line on the drawing.

Suitably said separating apparatus 2 including feeding- 38 and resting- 40 gates, feeding passage 12 and concentrate supply means 18 are associated with a not shown control unit of a common type for manoeuvring said apparatus and components in dependency of the present animal status. Said control unit, which is previously known per se, is interacting with a commonly used transponder (not shown) carried by each animal, by means of a corresponding transponder reader (not shown) associated with said identification gate 44 at the entrance into said separating apparatus 2.

Fig. 3 is a view of an alternative arrangement of the embodiment in fig. 2, in which the second 22 and third 24 animal stalls are each provided with a separate automatic milking means 52 and 54 respectively.

Fig. 4 shows an alternative arrangement of the embodiment in fig. 3, in which the second 22 and third 24' animal stalls are located in a tandem configuration and are each provided with a separate automatic milking means 56 and 58 respectively.

Fig. 5 is a view of an alternative arrangement of the embodiment in fig. 4, in which the second 22 and third 24' animal stalls are provided with a common automatic milking means 60. Said milking means is displaceably arranged on rail 62, which means that the milking means 60 can be moved from the second 22 animal stall for performing of a milking sequence in the third 24' animal stall and conversely.

Each of the gates associated with the separating apparatus 2 is a one-way gate, except for the separation gate 46, which preferably is a pivotable gate. The one-way gates may be of a conventionally hinged-, sliding- or revolving-door type and with a single or double door-blade design, such as a "saloon-door" type. The gates may be pressed open by an animal and urged to a closed position by means of a spring load or by gravity force. Also the gates may be provided with a conventional gate operating equipment, e.g. which is electrically, pneumatically, hydraulically, mechanically manoeuvred or combinations thereof.

10 A herd of, for example cows is free to move around in the first section 8 of the area 4 and e.g. eat forage at the feeding passage 12. A cow may lie down in one of the booths 16 in the resting area 10 and may be provided with a fodder concentrate at one of the concentrate supply means 18. If a cow reports at the identification gate 44, the animal carried transponder will be identified by means of the transponder reader, which is associated with said identification gate, in combination with the control unit of the system.

If the cow is identified as due for milking, she is allowed to pass the identification gate 44 into the entrance passage 42 and, the separation gate 46 being in its second position (shown with a continuous line), further into the second animal stall 22. If said second animal stall is occupied the cow may proceed into the third animal stall 24. The respective exit gate 34 and 36 is closed during the milking by means of the control unit and the cow may drink water from the appropriate water supply means. During the milking sequence, the milk quality is analysed and recorded for each cow by means of said control unit. After the automatic milking means 48, 52, 54, 56, 58, 60 has completed the milking sequence, the respective exit gate is opened by means of said control unit and the cow exits the animal stall into the second or separation section 14 and said exit gate is closed.

If the milk quality is approved, the cow is allowed to pass into the first section 8 either through the feeding gate 38 or the resting gate 40. If the milk quality is not approved, e.g. if mastitis is indicated, the cow is kept in said separating section 14 as an "alarm cow", which may be displayed by means of the control unit. Said "alarm cow" may be manually removed from said separation section by means of a not shown removal gate. Hence, even cows too sick to eat will be milked accordingly.

Advantageously, a herd-management system is achievable by means of the separating apparatus 2. If a cow over a predetermined time period, say 4-6 hours, does not even report at the identification gate for water, this is a typical sign for an "alarm cow", and the control unit will indicate appropriately.

Suitably, if a cow which is not due for milking reports at the identification gate 44, said separation gate 46 is pivoted to its first position (shown in broken lines) and then said identification gate 44 allows the cow into the entrance passage 42 and further into the first animal stall 20. Here the cow may drink water from the water supply means 26 and is allowed to exit from there through the exit gate 32 into the first section 8. The cow is free to move in this section between the feeding passage 12 and the resting area 10.

The function is similar in the second embodiment of fig. 2 and the alternatives of figures 3-5. Advantageously, the second 28 and third 30 water supply means are omitted and the first water supply means is transferred from the first animal stall 20 to a location in the entrance passage 42, between the identification gate 44 and the separation gate 46. Hereby it is achievable to provide water for all categories of cows at one single position in the system.

Hence, by means of said first and second embodiments of the invention it is possible to satisfy all the need of water for all categories of animals. By measuring the water

consumption for each animal and by means of the identification means (transponder and reader) save a record in the control unit, it is easy to follow the drinking routines over time for each animal. Further it is advantageous to save a record about the animals drinking habits and routines and compare with what actually happens, which can give a first, very early indication that an animal is going to be sick.

In the alternatives shown in figures 3-4 it is suitably arranged that the second 22 and third 24; 24' animal stalls each are provided with a separate automatic milking means 52, 54; 56, 58 respectively. In figures 4-5 is shown a configuration with the second 22 and third 24' animal stalls arranged in tandem. That is if said third animal stall 24' is occupied the exit gate 34 is kept closed and milking may take place in the second animal stall 22. If also the latter is occupied, the cow will have to wait at the identification gate 44 or may choose to get to the feeding passage 12 or lie down and rest if desirable, before next try at the identification gate. The tandem configuration shown in fig. 5 utilises a displaceable automatic milking means 60, which is movable to perform milking in either of said second 22 and third 24' animal stalls.

Even if the different embodiments and alternatives of the separating apparatus 2 is described in connection with the area 4 and appurtenant components, the location and orientation of said separating apparatus 2, in a loose-housing system or a free walking grazing system, may be altered depending on the present demand which has to be met in the farm in question.

Advantageously, the separating apparatus may be arranged as an "island" somewhere in a building or an area, where the animals are free to pass by.

Even if the water supply means 26 according to the alternatives of the second embodiment as disclosed in figures 3-5 is arranged before the separating gate 46, it is also achievable to arrange a water supply means in each of the animal stalls, in similarity to the first embodiment disclosed in fig. 1.

Claims

1. An apparatus (2) for separating animals, comprising at least a first (20) and a second (22) animal stall and a separation gate (46) associated with means (44) for identifying an animal individually, **characterized in** that at least one of said first and second animal stalls (20, 22) is provided with a water supply means (26, 28, 30) and in that said separation gate (46) is arranged to allow at least a first category of animals into said first animal stall (20) and at least a second category of animals into the other (22).
10
2. An apparatus (2) for separating animals, comprising at least a first (20) and a second (22) animal stall and a separation gate (46) associated with means (44) for identifying an animal individually, **characterized in** that at least one water supply means (26') is provided before said separation gate (46), which is arranged to allow at least a first category of animals into said first animal stall (20) and at least a second category of animals into the other (22).
15
3. An apparatus according to claim 1, **characterized in** that both of said first and second animal stalls (20, 22) are provided with a water supply means (26, 28).
20
4. An apparatus according to one of claims 1-3, **characterized in** that said first animal stall (20) exits into a first section (8) for said first category of animals and at least said second animal stall (22) exits into a second section (14) for said second category of animals.
25
5. An apparatus according to one of claims 1-4, **characterized in** that said second animal stall (22) is associated with a third animal stall (24, 24'), which animal stalls are provided with at least one common automatic milking means (48, 60).

6. An apparatus according to one of claims 1-4, **characterized in** that said second animal stall (22) is provided with one separate automatic milking means (52, 56).
- 5 7. An apparatus according to claim 6, **characterized in** that said third animal stall (24, 24') is provided with one separate automatic milking means (54, 58).
8. An apparatus according to one of claims 5- 7, **characterized in** that said milking means (48, 52, 54, 56, 58, 60) is arranged for automatic milking of each animal in-
10 dividually.
9. An apparatus according to one of claims 4-8, **characterized in** that one of said first and second sections (8; 14) comprises a feeding- and resting- area (10) with at least one feeding station (12, 18).
- 15 10. An apparatus according to claim 9, **characterized in** that the other one of said first and second sections (8; 14) comprises a separating section (14) for separation of a predetermined category of animals from the herd.
- 20 11. An apparatus according to claim 10, **characterized in** that said predetermined category contains said first category of animals.
12. An apparatus according to claim 10, **characterized in** that said predetermined category contains said second category of animals.
- 25 13. An apparatus according to one of claims 1-12, **characterized in** that said water supply means (26, 26', 28, 30) is arranged to supply drinking water.

14. An apparatus according to one of claims 5-13, **characterized in** that said identification means (44) is arranged to allow an identified animal to enter into one of said animal stalls (22, 24, 24') being provided with the automatic milking means (48, 52, 54, 56, 58, 60) only when it is reported as available and the animal in question is identified as ready for milking.

15. An apparatus according to any of the preceding claims, **characterized in** that said first category of animals involves cows which are due for milking and that said second category of animals involves cows which are not due for milking.

16. An apparatus according to one of the preceding claims, **characterized in** that said first category of animals involves cows too sick to eat.

17. An apparatus according to one of claims 1-15, **characterized in** that said second category of animals involves cows too sick to eat.

18. An apparatus according to one of the preceding claims, **characterized in** that the first (20), the second (22) and a third (24) animal stall, are arranged in a side by side configuration.

19. An apparatus according to one of claims 1-17, **characterized in** that the first (20) and second (22) animal stalls are arranged in a side by side configuration and that the second (22) and third (24') animal stalls are arranged in a tandem configuration.

20. A method of separating animals, comprising the following steps:
- providing at least a first (20) and a second (22) animal stall and a separation gate (46) associated with means (44) for identifying an animal individually;

characterized by providing at least one of said first and second animal stalls (20, 22) with a water supply means (26, 28, 30) for separate watering of each animal;
- allowing at least a first category of animals to enter into said first animal stall (20) and at least a second category of animals to enter into the other (22) by means of said separation gate (46).

21. A method of separating animals, comprising the following steps:

- providing at least a first (20) and a second (22) animal stall and a separation gate (46) associated with means (44) for identifying an animal individually;

characterized by providing at least one water supply means (26') before said separation gate (46) for separate watering of each animal;
- allowing at least a first category of animals to enter into said first animal stall (20) and at least a second category of animals to enter into the other (22) by means of said separation gate (46).

22. A method according to claim 20 or 21, characterized by allowing said first category of animals to exit from said first animal stall (20) into a first section (8) and allowing said second category of animals to exit from at least said second animal stall (22) into a second section (14).

23. A method according to one of claims 20-22, characterized by associating said second animal stall (22) with a third animal stall (24, 24') and provide said animal stalls with at least one common automatic milking means (48, 60).

24. A method according to claim 23, characterized by performing automatic milking of each animal individually by means of said milking means (48, 60).

25. A method according to one of claims 22-24, characterized by performing feeding and resting of said animals by means of arranging a feeding- and resting-

area (10) with at least one feeding station (12, 18) in at least one of said first and second sections(8; 14).

5 26. A method according to one of claims 22-25, **characterized in** that a predetermined category of animals is separated from the herd by means of providing at least one of said first and second sections (8; 14) with a separating section (14).

10 27. A method according to claim 26, **characterized in** that said predetermined category is said first category of animals.

28. A method according to claim 26, **characterized in** that said predetermined category is said second category of animals.

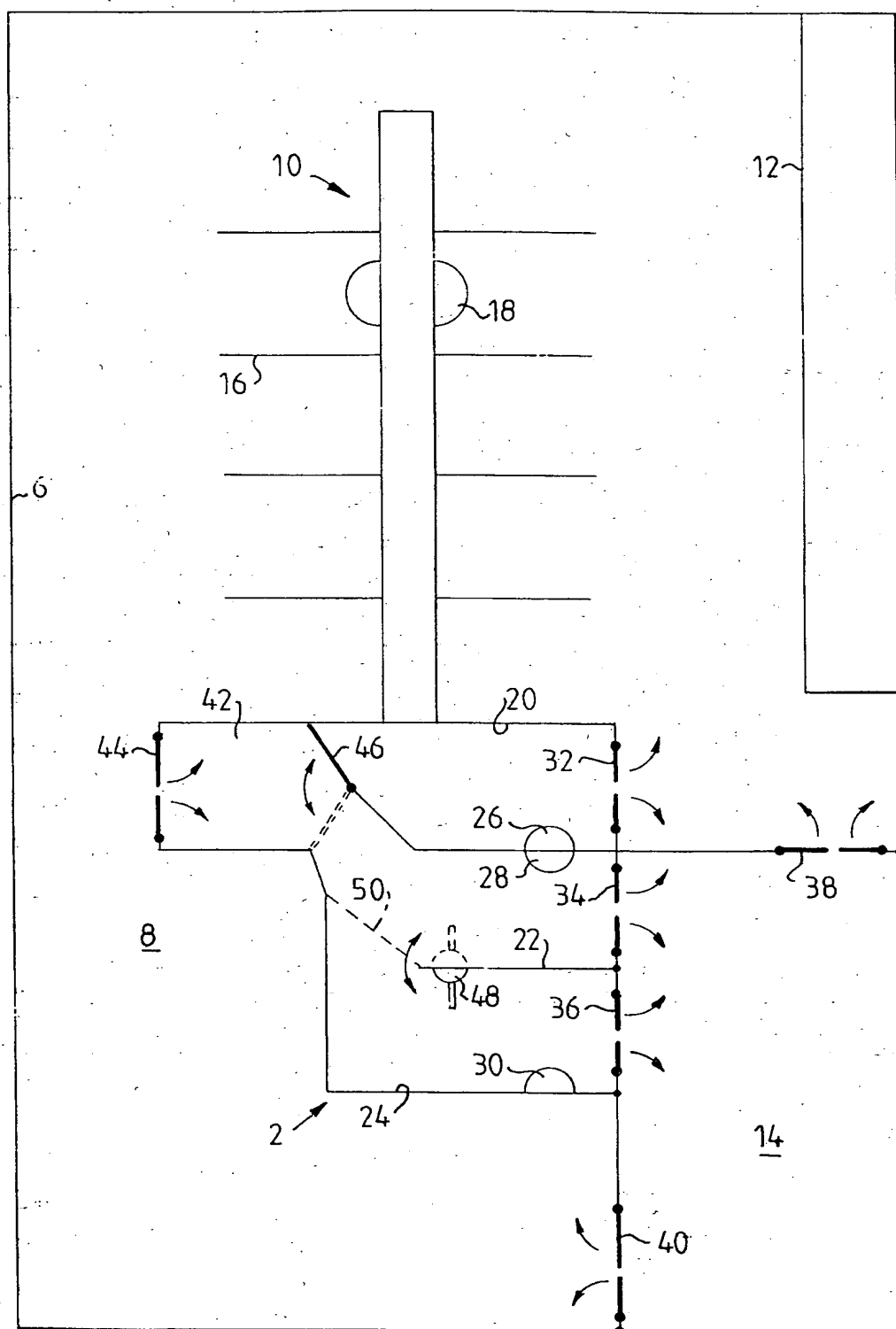
15 29. A method according to one of claims 20-28, **characterized in** that drinking water is supplied by means of said water supply means (26, 26', 28, 30).

20 30. A method according to one of claims 22-29, **characterized in** that an identified animal is allowed to enter into said animal stall (20, 22, 24, 24') being provided with an automatic milking means (48, 52, 54, 56, 58, 60) only when it is reported as available and the animal in question is identified as ready for milking by means of said identification means (44).

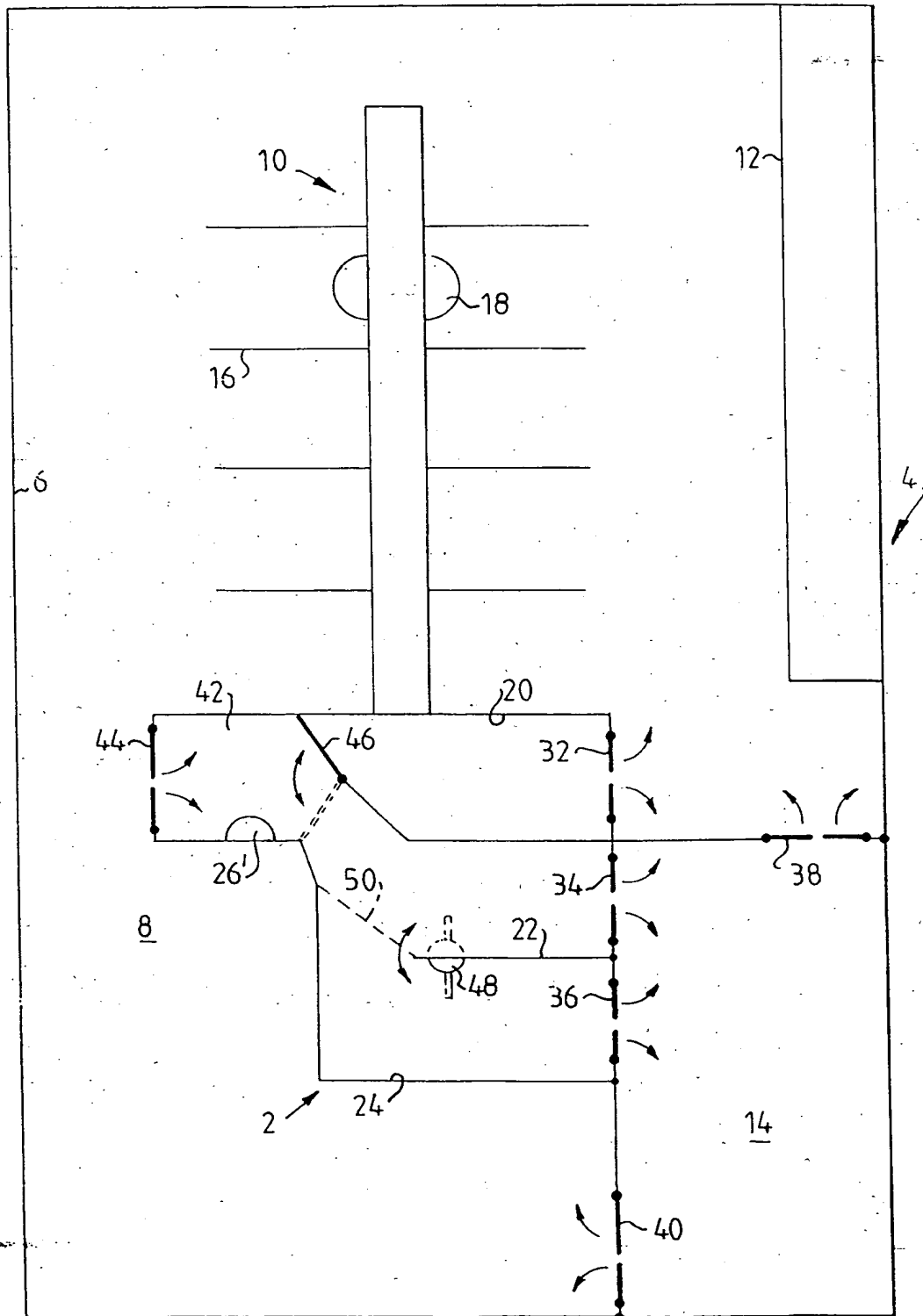
25 31. A method according to one of claims 20-30, **characterized in** that a record about the drinking habits and routines of each animal is saved in a control unit and that said record is compared with the present drinking habits and routines of each animal, to get an indication on differing behaviour.

32. A method according to claim 31, **characterized in** that said record and comparison are used to get a first indication that an animal is going to be sick.

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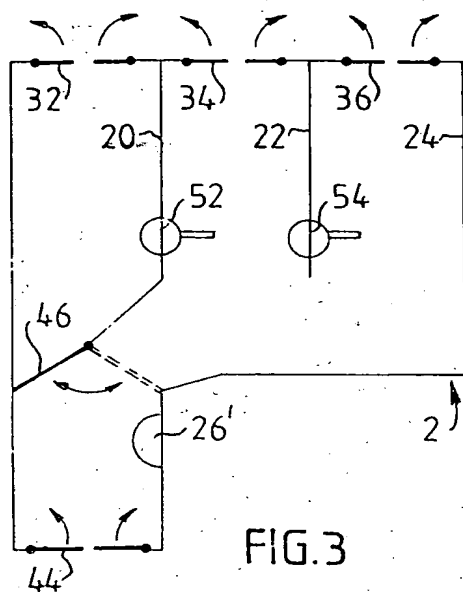


FIG. 3

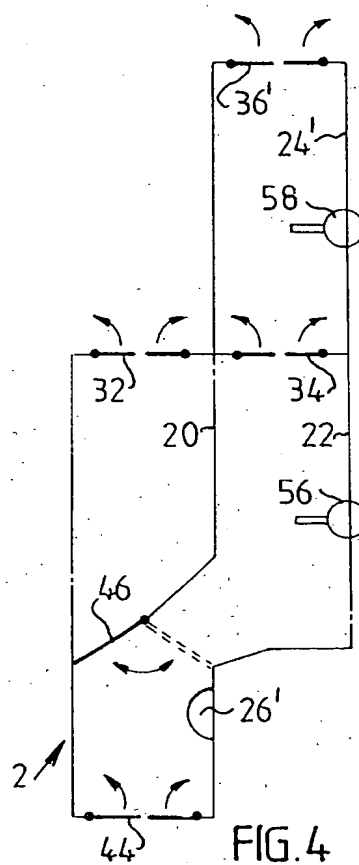


FIG. 4

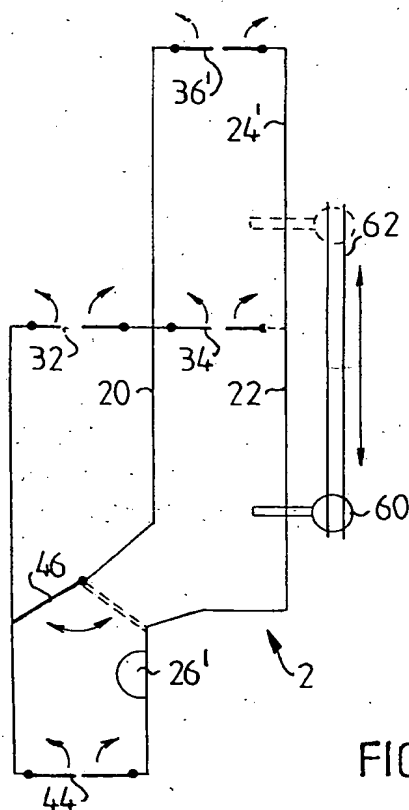


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/01188

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A01K 1/12 // A01K 1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A01K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Landtechnik, Volume 45, No 12, December 1990, (Lehrte, Germany), Von Rudolf Armann et al, "Entwicklungsstand von melkrobotern", figure 5 --	1-32
Y	WO 9619917 A2 (TETRA LAVAL HOLDINGS & FINANCE S.A.), 4 July 1996 (04.07.96), page 9, line 10 - line 16; page 21, line 31 - line 33; page 23, line 26 - line 29, figures 6A-6B --	1-30
Y	US 4617876 A (HAYES), 21 October 1986 (21.10.86), column 1, line 45 - column 2, line 36 --	31-32

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search

8 October 1999

Date of mailing of the international search report

28 -10- 1999

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/01188

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 3702465 A1 (DÜVELSDORF & SOHN GMBH & CO KG), 11 August 1988 (11.08.88), column 6, line 20; column 6, line 42; column 7, line 58 - line 62, figure 5, column 8, lines 15 - lines 17 --	1-32
P,Y	US 5782199 A (OOSTERLING), 21 July 1998 (21.07.98), abstract -----	1-32

INTERNATIONAL SEARCH REPORT

Information on patent family members

28/09/99

International application No.

PCT/SE 99/01188

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9619917 A2	04/07/96	AU 4360796 A EP 0800341 A SE 9404538 D SE 9404540 D SE 9404541 D	19/07/96 15/10/97 00/00/00 00/00/00 00/00/00
US 4617876 A	21/10/86	NONE	
DE 3702465 A1	11/08/88	DE 3888890 D EP 0300115 A,B	00/00/00 25/01/89
US 5782199 A	21/07/98	CA 2196089 A DE 69505133 D,T EP 0772389 A,B EP 0853875 A JP 10503088 T NL 9401238 A WO 9603031 A AU 4846796 A EP 0873234 A NL 1002287 A,C NL 9500261 A WO 9625286 A	08/02/96 18/02/99 14/05/97 22/07/98 24/03/98 01/03/96 08/02/96 04/09/96 28/10/98 00/00/00 02/09/96 22/08/96